A COMPARISON OF THE MACHINERY REPAIR WORK DONE ON THE HOME FARM BY BOYS WITH AND WITHOUT VOCATIONAL AGRICULTURE TRAINING

by

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INTRODUCTION

Just as traveling without a good road map is likely to lead one away from his destination, so will teaching without well formulated objectives fail to accomplish desired results. After the route has been carefully outlined on the road map, it is necessary to check occasionally to be sure that the right course is being followed. Likewise it is necessary for a teacher to check his results that he may know how accurately the objectives are being reached.

The course in vocational agriculture, as designated by the Kansas State Board for Vocational Education, provides that not to exceed two-fifths of the time allotted to vocational agriculture shall be given to farm-shop instruction. Various objectives have been selected as guides in organizing the farm-shop courses for these vocational agriculture schools. According to Cook, Scranton, and McColly (5), the broad objectives of the farm mechanics course are, "To train boys to do the ordinary construction and repair work that needs to be done on the average farm with the tools the average farmer may reasonably be expected to have".

Sharp and Sharp (11) have summed up their farm mechanics objectives as follows:

> To help make the boy a more efficient farmer by giving him knowledge, skills, ideals, and appreciations needed to make him proficient in the selection, operation, care, and repair of the machinery and equipment necessary for modern farming, and in doing such other construction and repair work as may be profitably done by efficient farmers.

DeAlton (8) in giving the objectives as developed by a group of prospective teachers at the North Dakota Agricultural College stated:

> The final thought, however, was that to be effective the course should aim at more than developing certain manipulative skills, the inclusion of a given number of projects, or the turning out of a large amount of shop work. Instead, the group felt that for the course to be effective it should develop the student's ability to do good thinking, that it should aim to help the boys to become more efficient farmers by developing proficiency in (1) the selection, operation, care, and repair of farm machinery and equipment necessary in modern farming, and (2) doing the ordinary repair and construction jobs that could be done by the farmers in their communities.

Other authorities have formulated objectives and standards to be followed in organizing the course in farm mechanics, but they all agree to the same general aim, namely: to prepare the boy for doing those shop jobs which will need to be done on the farm, and encourage him to equip the home farm shop for doing this type of work. This study was made to determine to what extent the vocational agriculture farm shops have met these needs.

Shop courses of some type are taught in most of the high schools of the state. In many of these it has been the traditional manual-training type. An increasing number of schools each year are attempting to offer shop courses designed to more nearly meet the needs of the boys enrolled. Some of these are offering general shop-courses which include the skills for a number of enterprises, while others are offering courses in the more specialized fields.

Near the centers of industry the shop training tends to run toward specialization, while in the rural sections the general type of shop seems to meet the varied needs of those enrolled. The present war program has called for more rapid training in the specialized fields. Various attempts have been made toward developing more practical courses, rather than merely providing busy work or pastime for the boys.

Many attempts have been made to determine the needs of the boys who are enrolled in these classes. Most of these have been based upon the needs of the adults who are in the positions which these boys will probably occupy at some later date.

Davidson, (7) in his study of mechanical activities of Kansas farmers, gave some interesting information on the type of shop jobs the farmers are doing and the type of jobs for which the farm boys need to be prepared. Pollom (9) followed this by a study made of the scope and content of farm mechanics courses determining the type of instruction which is being given in the vocational agricultural farm shop. This was a step undertaken to determine how well this instruction is meeting the needs of the farmers of the future.

While this information is of great value in organizing a course of study, it must be recognized that there was no doubt a need for many types of work on these farms, which were not undertaken because of a lack of training in these skills. The increasing use of high-powered automatic farm machinery during the past 10 years has brought about the needs for additional skill training in mechanics work.

Clegg (2) made a study of the methods of teaching and plans for checking results in farm woodworking and farm carpentry by teachers of vocational agriculture. He found that most teachers check results by grading the finished project in the shop, which may be the best means available for obtaining a grade for school work. However, if the objectives are to be those previously cited, the final and more accurate check on results should be to discover what mechanical activities are being carried on by the boys on their own home farms in their after-school years.

After several years of teaching vocational agriculture and striving to meet the objectives as given above, it seemed desirable to find a means of measuring the results of this work. For this purpose, it was decided to have a study made of the accomplishments in this field, as measured by the activities of the farm boys who have completed the instruction offered in vocational agriculture.

The purpose, then of this study has been to determine to what extent the training in vocational agriculture has functioned in securing participation in shop activities by the boys on their home farms, with the hope that the findings may be of some benefit to other teachers in organizing their shop courses to fit the needs of the farm boy more effectively than in the past. This study was made by comparing the mechanical activities of boys who had had vocational agriculture with a similar group who had had no opportunities for such training, except manual training in high school.

METHOD OF PROCEDURE

In making the study boys were selected who have been graduated from high school for at least one year and for not more than five years. Five schools were selected which have offered vocational agriculture long enough to have graduates in vocational agriculture who have been out of high school five years. Five other schools not offering vocational agriculture, but otherwise in as nearly the same type of community as possible, were selected as a check group in making the study.

In the schools of the first group the instructor of vocational agriculture was asked to submit a list of all boys who had completed all work offered by his department and graduated from high school in the classes of 1936, 1937, 1938, 1939, and 1940 and who were still living on the farm. The schools cooperating in this study were Altamont, Howard, Chanute, Fredonia, and Neodesha.

In the schools not offering vocational agriculture, the principal of the high school was asked to submit a list of all farm boys graduated from their high school during the same years as given above, and who were still living on the farms. One school from this group was unable to cooperate, leaving only four schools represented. The cooperating schools were: Erie, Humboldt, Moline, and Altoona.

Data were secured through personal interview, by visiting each boy and filling in the check sheet while conducting the interview. Every boy whose name had been submitted was visited and every boy interviewed was living on the farm at the time, although some have since gone into military service or some type of war work. Every precaution possible was taken to avoid other influencing factors than the instructional program. The data were collected with the aid of check sheets (appendix) during the period from August 1, 1941, to June 1, 1942.

Seventy-six boys were included in this study, 35 of whom were vocational-agriculture boys from the five schools mentioned above and 41 non-vocational-agriculture boys from the four non-vocational schools. The mean age of the former group was 20.7 years and of the latter group was 21.4 years. The ages ranged from 18 to 26 years in the vocational-agriculture group and from 17 to 25 in the check group. Every boy interviewed showed a fine spirit of cooperation after the purpose of the study was explained. It was made clear to each boy that accurate replies were desired and that there would be no personal mention given to either himself or his school.

The boy's status in farming and his training in mechanical skills were included in the survey as a means of helping to interpret the other phases of the study. In checking the mechanical work done on the farm, five farm implements were selected on the basis of their being most likely to be found on every farm and those implements which would present as wide a variation in mechanical skills as possible. The various repair operations were listed for each of these implements. In preparing the list of repair operations, various text books dealing with the repair of farm machinery were studied and the list checked with men in charge of the Shop Practice Department of Kansas State

College in order that the lists might be as nearly complete and representative as possible for each implement. The conclusions drawn as a result of this study have been based on the assumption that the repair of the selected implements, as performed by the boy, was representative of the repair work done on all farm machinery on his farm. Each boy was requested to indicate if he had performed each of the repair operations himself, helped someone else, or whether the job had been done by some other person on the farm. If the particular job had not been done on the farm he was asked to indicate a reason why it had not, as indicated on the check sheet.

FINDINGS RESULTING FROM THE STUDY

The farming status of the boys interviewed is given in Table 1 which shows that the percentage differential of the boys working for their fathers and having vocational-agriculture training compared to those without this training is 30.6 per cent greater in the latter group. This indicates that the training and experience in vocational agriculture has helped the boys in getting away from the "hired hand" idea on their home farm, as a study of Table 1 definitely indicates. The fact that there is a difference of 24.9 per cent in the number of boys who worked for their fathers with one or more enterprises for themselves is a further indication that these boys are on the road to ownership in their own business. A few more of the non-vocational-agriculture boys had left the home farm and were working on other farms than had the boys of the vocational-

Table 1. Showing farming status of farm boys by percentage.

Farming status	Voc.Ag. boys	Non-Voc. Ag. boys	Difference in percent
Working for father	5.7	36.3	30.6
Partnership with father	25.7	24.4	1.3
Working for father, enterprises for self	37.1	12.2	24.9
Working for others	5.7	7.3	1.6
Farming for self	25.7	19.5	6.2
Farm owned by operator	57.1	65.9	8.8
Lived on farm less than 5 years	28.6	24.4	4.2
Lived on farm 5 to 10 years	11.4	7.3	4.1
Lived on farm 10 to 15 years	25.7	19.5	6.2
Lived on farm since birth	34.1	48.8	14.7

agriculture group. Of those boys who were farming for themselves there was a difference of 6.2 per cent in favor of those with the training in vocational agriculture.

More non-vocational-agriculture boys were living on farms owned either by themselves or their fathers by a margin of 8.8 per cent. This would tend to give this group an advantage towards becoming established in farming for themselves. Another advantage which would seem to favor this group is that they had lived on the farms on which they were then living longer than had the vocational-agriculture boys. This is shown by the fact that there were 4.2 per cent more vocational-agriculture boys who had lived less than five years on their present farm, 4.1 per cent more who had lived there from five to 10 years, and 6.2 per cent more who had lived there from 10 to 15 years, while there were 14.7 per cent more non-vocational-agriculture boys who were living on the farm on which they were born.

In summarizing the results as presented in Table 1, it is found that 88.5 per cent of the vocational-agriculture boys had taken a step towards farming for themselves, by being in partnership with their fathers, carrying some enterprises of their own or farming for themselves. Only 56.1 per cent of the non-vocational boys had taken such steps towards becoming established in farming. It would appear that those boys who have had the advantages of vocational-agriculture training are closer to becoming established in farming for themselves than are those who have not had this training. The non-vocational-agriculture group had advantages which would offset in a measure the shop training advantages of the vocational boys. The advantages, as formerly set forth, are in being slightly older, having lived on the same farm for a longer period of time, and showing a higher degree of parent ownership of land.

A comparison of the mechanical training received in high school by the two groups interviewed is given in Table 2 which reveals that 31.4 per cent of the vocational-agriculture boys have had some manual training and 20 per cent have had industrial arts in addition to their training in the vocational-agriculture shop. Of those who had the extra training 34.4 per cent had but one unit credit in the other shop courses. In all cases where instruction had been given in machinery repair, the indi-

Table 2. Showing mechanical training of farm boys by percentages.

Shop Course	Groups	Units of credit							
		1	2	3	4	5	6	7	8
Manual training	Voc. Ag.	25.7	5.7	0	0	0	0	0	0
	Non-Voc.Ag.	4.9	43.9	29.3	19.5	0	0	0	0
	Difference	20.8	38.2	29.3	19.3	0	0	0	0
Industrial arts	Voc. Ag.	8.6	5.7	0	5.7	0	0	0	0
	Non-Voc.Ag.	0	2.5	2.5	0	0	0	0	0
	Difference	8.6	3.2	2.5	5.7	0	0	0	0
Vocational agriculture	Voc. Ag.	0	0	0	11.4	0	71.4	0	17.1
	Non-Voc.Ag.	0	0	0	0	0	0	0	0
	Difference	0	0	0	11.4	0	71.4	0	17.1

vidual check sheets showed that this instruction had been given in the vocational-agriculture shop. Since manual training courses give training only in woodwork, it is not likely that the vocational-agriculture boys received much help for the machinery-repair operations from these manual-training courses. Of the vocational-agriculture boys interviewed, 88.5 per cent had six units or more in vocational agriculture, while 95 per cent of the non-vocational boys had had no mechanical instruction other than that received in manual training. The individual check sheets revealed that none of the boys who had no vocational agriculture had received any specific instruction in the repair of farm machinery. Of course their training in woodworking skills may be of considerable advantage to them in performing machinery-repair operations involving woodwork.

Table 3. Showing kinds of locations for farm machinery repair by percentages.

Place for repair work	Voc. Ag. boys	Non-Voc. Ag. boys	Difference in percent
Under a tree	14.3	12.2	2.1
Beside a house or barn	14.3	24.4	10.1
Corner of barn	2.9	0	2.9
In the garage	11.4	19.5	8.1
Regular shop	28.6	29.3	.7
Implement shed	17.1	9.8	7.3
Granary or driveway	5.7	4.9	.8
Where it breaks	5.7	0	5.7
Heated shop in cold weather	17.1	14.6	2.5
Room for implements inside	62.9	48.8	14.1

The place where the repair work was done on these farms is indicated by Table 3. It might be observed that 28.6 per cent of the vocational-agriculture boys did their repair work in the open, either under a tree or beside a building, while 36.6 per cent of the non-vocational-agriculture boys worked in the open. Forty-five and seven-tenths per cent of the vocational-agriculture boys had a regular shop, or a place in an implement shed, in which their repair work was done. On the other hand only 39.1 per cent of the boys from the check group worked under these conditions. Table 3 shows a difference of 2.5 per cent in the number of boys who had a shop which could be heated in cold weather and a difference of 14 per cent in the number of boys who could take the implements inside a building for repair work, both differences favoring the vocational-agriculture boy.

These comparisons indicate that boys trained in the vocational-agriculture shop had a better working environment than those without this training. The fact that 5.7 per cent of the vocational-agriculture boys had no definite place for repair work is probably a result of there being more of these boys living on rented farms than of the other group, as shown in a former table. In general, rented farms are not well equipped with buildings suitable for use as a shop.

In checking the storage of tools as shown in Table 4, it will be noted that more of the vocational-agriculture boys had some definite place for keeping tools than those of the non-vocational group. This table shows that 74.3 per cent of the vocational-agriculture boys had an organized system of keeping tools either in tool cabinets, or racks above the work bench, while only 53.7 per cent of the non-vocational-agriculture boys cared for their tools in an organized way. On the other hand there were 46.5 per cent of the non-vocational group who left their tools lying on the work bench, in the implement, or wherever they were last used; having no organized method of caring for them and only 25.7 per cent of the boys from vocational-agriculture departments who reported this lack of organization. While no check was made upon the reason for the difference in the number having tool cabinets in each group, no doubt the difference was brought about by the vocational boy having

Table 4. Showing where tools were kept by farm boys (percentages).

Where tools are kept	Voc. Ag. boys	Non-Voc. Ag. boys	Difference in percent
Tool chest or cabinet	45.7	22.0	23.7
Tool racks above work bench	28.6	31.7	3.1
Lying on work bench	5.7	19.5	13.8
In tool boxes on implements	5.7	24.5	18.8
No definite place	14.3	2.5	11.8

either made tool cabinets in the school farm shop or receiving the incentive there for organizing a racking system for the tools on his farm. No check was made of boy ownership of tools. This might be suggested as an interesting and worthwhile study to be made at a later date.

The ownership of implements studied was included as a means of helping to interpret the data secured from the other parts of the survey. Table 5 shows that for each of the implements included in the survey, the non-vocational boy had a larger percentage of ownership than the vocational boy. While the degree of ownership is not shown in this table, the individual check sheets gave this information. Ownership of an implement as shown in the table may indicate any degree from one-third to complete ownership. It might be expected that boys who own implements or have a financial interest in them would do more repair work than on implements in which they have no interest.

Table 5. Showing percentage of farm boys who have ownership in farm machinery.

Kind of implement	Voc. Ag. boys	Non-Voc. Ag. boys	Difference in percent
Mower	8.6	22.0	13.4
Plow	25.7	26.8	1.1
Grain drill	8.6	19.5	10.9
Gasoline motor	25.7	31.7	6.0
Wagon	17.1	22.0	4.9

No apparent reason is available to explain why there was a larger ownership of farm implements by the non-vocational boys, but it is possible that this is because the two non-vocational communities, which showed the larger boy-ownership according to the survey, were those representing more wealth from sources other than the farm. The farm incomes from the communities of Humboldt and Moline have been supplemented by oil royalties, either directly or indirectly. The greater purchasing power thus made available would make it possible for the father to give his son advantages otherwise not possible.

Considerable difference in percentage of vocational-agriculture boys and non-vocational-agriculture boys was observed, who had performed the repair operations on the mower, helped with the repair, or where the repair was done by someone else on the farm. These differences are shown in Table 6.

Of the 26 repair operations listed for the mower, 25 were performed more frequently by the vocational-agriculture boy than by the non-vocational boy. There were four of the operations in which the vocational boy helped more than the non-

Table 6. Showing the difference in the percentage of vocational-agriculture and non-vocational-agriculture boys who performed the repair operations on the mower.

Repair operations	Group	Boys taught job in H.S.	Operations done on farm			If not done why not				
			By boy alone	Boy helped	By others	No tools	Lack of skill	Lack of time	No need	Neglect
Correct lead of cutter bar	V.A.	62.9	16.1	2.1						.8
	N.V.A.				6.9	2.5	2.5	0	7.3	
Check centering of knife	V.A.	62.9	22.6				.4			1.3
	N.V.A.			2.0	11.7	4.9		0	5.7	
Adjust for wear of yoke pins	V.A.	17.1	4.6	8.3					10.7	.8
	N.V.A.				19.5	2.5	2.5	0		
Replace guards	V.A.	17.1	12.2						2.9	
	N.V.A.			5.2	9.8					
Replace ledger plates	V.A.	28.6	8.4						2.9	2.9
	N.V.A.			9.3	4.9					
Align Guards	V.A.	17.1	13.7							2.9
	N.V.A.			5.2	7.3				4.1	
Replace wearing plates	V.A.	25.7	15.3							
	N.V.A.			2.8	6.9			2.5	.8	2.5
Straighten knife clips	V.A.	14.3	1.5	7.0					.9	
	N.V.A.				9.3					
Replace knife clips	V.A.	11.4	6.8						.5	
	N.V.A.			.3	6.9					

Table 6. (Contd.)

Replace knife head guides	V.A.	8.6	16.1						
	N.V.A.			2.4	9.3			4.4	
Adjust inner shoe	V.A.	2.9	21.5						
	N.V.A.			8.9	2.0			10.6	
Adjust outer shoe	V.A.	2.9	16.6						
	N.V.A.			8.9	2.0			5.7	
Repair divide board	V.A.	2.9	9.7					6.1	
	N.V.A.			8.9	2.0				4.9
Replace sections	V.A.	25.7	5.7		.4			2.9	
	N.V.A.			8.9					
Sharpen sickle	V.A.	17.1	19.5					2.9	
	N.V.A.			20.7	2.0				
Replace knife head	V.A.	11.4	19.4			2.9	2.9	.5	
	N.V.A.			18.7	6.9				
Straighten knife back	V.A.	5.7	26.7					2.1	
	N.V.A.			16.6	12.2				
Replace dogs and springs	V.A.	20.0	8.0					14.3	
	N.V.A.			5.2	17.1				
Replace bearings	V.A.	20.0	20.5						
	N.V.A.			4.4	12.2			3.9	
Replace clutch parts	V.A.	17.1	.9					17.7	
	N.V.A.			9.7	8.9				

Table 6. (Concl.)

Replace worn gears	V.A.	11.4	9.9					2.9
	N.V.A.			.7	9.8		2.4	
Replace crank pin	V.A.	8.6		17.6				2.9
	N.V.A.		10.4		4.1	2.5	3.6	
Replace pitman shaft bearing	V.A.	2.9	21.8					2.9
	N.V.A.			7.3	11.7		5.7	
Replace pitman	V.A.		18.2					2.9
	N.V.A.			10.6	4.4		6.0	
Replace tongue	V.A.		3.9				13.2	2.9
	N.V.A.			10.1	9.8			
Straighten and adjust levers	V.A.		3.4				12.7	.4
	N.V.A.			11.7	4.9			

vocational and only one operation which was performed more frequently by others on the farm of the vocational boy, and that by only a difference of four-tenths per cent. It will be noticed that those jobs which showed a greater difference in the two groups in favor of the vocational-agriculture boy were for the most part those requiring a greater degree of skill in their performance. It is also observed that those jobs in which instruction was given more frequently were performed by a greater percentage of the boys visited. The mower was found on 100 per cent of the farms visited and is probably an implement which is repaired on the home farm more frequently than any other implement, so is perhaps as nearly representative of the repair situation as any one implement which could be selected.

A summary from the study of repair operations on the plow is found in Table 7. The plow was found on 100 per cent of the farms of the vocational-agriculture boys visited and on 97.5 per cent of the non-vocational group. Twenty-three repair operations were listed for the plow. Of these, 17 were performed alone by more of the boys who had studied vocational agriculture than by those who had not had this instruction. There were six jobs which more vocational boys had helped do than had the non-vocational boys, while in 14 of the jobs the non-vocational boys helped more. Neither group had helped in doing three of these operations. Only one job had been done more by others from the vocational-agriculture group and that by a difference of eight-tenths per cent. Those operations

Table 7. Showing the difference in the percentage of vocational agriculture and non-vocational agriculture boys who performed the repair operations on the sulky or gang plow.

Repair operations	Group	Boys taught job in H.S.	Operations done on farm			If not done why not				
			By boy alone	Boy helped	By others	No tools	Lack of skill	Lack of time	No need	Neglect
Sharpen share	V.A.	31.4	17.5	5.7		22.5			2.9	
	N.V.A.				9.3		36.9			
Adjust wing bearing	V.A.	8.6	9.4			24.9			8.9	
	N.V.A.			2.0	4.4		34.5			
Repoint share	V.A.	2.9	5.7			17.6			2.9	
	N.V.A.				4.9		21.3			
Adjust vertical suction	V.A.	17.1		.8		3.2			18.8	
	N.V.A.		6.7		4.4		9.3			
Adjust land suction	V.A.	14.3							20.8	
	N.V.A.		2.1	4.1	9.8	2.5				
Replace landslide	V.A.	2.9	18.0							2.9
	N.V.A.			3.2	2.0		2.5		10.8	
Tighten moldboard	V.A.								15.6	
	N.V.A.		4.6	6.0	2.5					
Polish moldboard	V.A.								20.8	
	N.V.A.		9.4	4.1	2.5					2.5
Straighten beam	V.A.		2.9			3.2			8.8	
	N.V.A.			6.9			5.7			

Table 7. (Contd.)

Tighten beam	V.A.	27.1							
	N.V.A.		14.6	2.5				7.6	
Replace broken braces	N.A.	5.1				.4		9.1	
	N.V.A.		7.3	4.9					
Tighten braces and bolts	V.A.	15.4					2.9		
	N.V.A.		11.7	2.5				1.6	
Sharpen rolling coulter	V.A.	28.3			3.2				
	N.V.A.		4.9	2.5		2.0		14.9	4.9
Replace rolling coulter bearing	V.A.	11.1	.4						
	N.V.A.			2.5				5.4	2.5
Adjust position of coulter	V.A.	11.4							
	N.V.A.		2.0	4.9				2.0	
Replace wheel bearings	V.A.	3.0		.8					
	N.V.A.		1.6					2.7	
Clean bearings and oilers	V.A.	21.1							
	N.V.A.		9.8	2.5				6.5	
Adjust angle of furrow wheels	V.A.	15.3							
	N.V.A.		7.3	2.5				3.1	
Replace worn collars	V.A.	18.9	1.6			.4			2.9
	N.V.A.			4.9				16.6	
Straighten frame	V.A.	9.8				3.2			
	N.V.A.				2.5			8.3	

Table 7. (Concl.)

Straighten levers	V.A.	4.4				5.4	
	N.V.A.			7.3			
Adjust spring tension	V.A.		.4			15.6	
	N.V.A.	6.2		7.3			
Paint plow	V.A.		5.7				10.3
	N.V.A.	8.5		2.5	2.5	.3	

the performance of which require skill training were performed alone by a greater margin of difference by the vocational-agriculture boy. Examples of such operations are sharpening and pointing plow shares, and sharpening rolling coulters. Such operations were also checked as not being done on the farm because of a lack of skill by more non-vocational-agriculture boys. Again it is noted that in general the jobs which were taught most frequently in school were the ones that had been performed by the most of the boys on the farm.

There were 20 job operations listed for the grain drill, of which 17 were done by more vocational boys than by the non-vocational group, as shown in Table 8. The grain drill was found on only 88.6 per cent of the vocational-agriculture farms visited and 73.2 per cent of the non-vocational. The grain drill was found less frequently than any of the implements used in the study. Vocational-agriculture boys helped more frequently with 14 of the jobs in repairing the grain drill than did the non-vocational boys and the latter exceeded in six of the repair jobs. In all of the operations the repair was done more frequently by someone else on the farm in the case of the non-vocational boys. The grain drill is probably the least used of the implements included in the study, and for a comparatively short season each year. There is therefore less need for repair on this machine than on other farm implements. This is also the most logical reason as to why more ownership of drills was not found on the farms visited. Farmers who plant small acreages of sowed grain borrow a drill from a neighbor expecting to

Table 8. Showing the difference in the percentage of vocational-agriculture and non-vocational-agriculture boys who performed the repair operations on the grain drill.

Repair operations	Group	Boys taught job in H.S. %	Operations done on farm			If not done why not				
			By boy alone	Boy helped	By others	No tools	Lack of skill	Lack of time	No need	Neglect
Rebuild box	V.A.			13.1		2.9			16.4	.4
	N.V.A.		.8		16.6					
Check planting rate	V.A.	34.1	10.8	1.6					2.9	9.8
	N.V.A.				9.8					
Replace worn gears	V.A.		5.8	2.9					18.9	
	N.V.A.				12.2					
Replace worn bearings	V.A.		2.5	2.5					22.6	
	N.V.A.				12.2					
Repair feed cups	V.A.			2.9					23.7	
	N.V.A.		4.4		6.9					
Replace broken flutes	V.A.		14.3						6.3	2.9
	N.V.A.			1.2	6.9					
Replace broken feed wheels	V.A.		.8	7.0					19.8	
	N.V.A.				12.2					
Replace worn links in chains	V.A.		8.3						13.6	
	N.V.A.			1.6	4.9					
Repair grain tubes	V.A.		21.7	1.3						
	N.V.A.				4.9				2.7	

Table 8. (Contd.)

Replace or repair discs	V.A.	10.7	7.3				
	N.V.A.			2.5		.3	
Replace or repair scrapers	V.A.		1.3			18.0	5.7
	N.V.A.	2.7		6.9			
Replace wheel bearings	V.A.	7.0				20.2	
	N.V.A.		6.9	4.9			
Adjust pressure springs	V.A.	15.6	1.3			2.5	2.9
	N.V.A.			6.9			
Replace broken springs	V.A.	11.1				21.0	
	N.V.A.		4.4	12.2			
Tighten bolts and braces	V.A.	18.2				3.7	
	N.V.A.		1.6	4.9			
Replace broken braces	V.A.	11.2	1.3			10.3	
	N.V.A.			7.3			
Replace tongue	V.A.	15.1	7.3			2.4	
	N.V.A.			9.8			
Replace dogs and springs	V.A.	11.5				15.3	
	N.V.A.		8.9	2.5			
Replace or repair drag chains	V.A.	32.4	1.6				
	N.V.A.			9.8		8.9	
Paint box	V.A.	4.1	6.5		.4	7.8	8.6
	N.V.A.			12.2			

loan other implements in return.

Work on the gasoline motor as given in Table 9 included the repair of any type of gasoline engine, whether in a car, tractor, or a stationary motor. The job operations listed in the repair of the gasoline motor were 29 in number. Of these 22 were performed by more vocational-agriculture boys than by non-vocational boys. Of these such jobs as require skill training, namely: taking up bearings, timing valves, and timing ignition showed greater difference in percentage than the less skilled jobs. Such jobs as repairing the fuel tank or the radiator showed considerable difference in favor of the vocational-trained boy and are to be accounted for because of the training in soldering and sheet metal work included as a part of the vocational-agriculture-shop training. In 14 of these repair operations the vocational-agriculture boys helped more frequently than did the non-vocational boys, while in 15 of these the non-vocational boys helped more. All vocational-agriculture boys reported gasoline motors on the farm and 97.6 per cent of the non-vocational boys. Only eight jobs were done more by others on the farms of vocational boys than on the farms of non-vocational boys. Of those jobs which were not done on the home farm because of a lack of skill there were 19 that were reported in a greater number of cases by non-vocational than by vocational boys and only six reported more often by the vocational boys.

Seventeen repair operations were included for the wagon (Table 10). These included the repair of the wagon box and the

Table 9. Showing the difference in the percentage of vocational-agriculture and non-vocational-agriculture boys who performed the repair operations on the gasoline motor.

Repair operations	Group	Boys taught job in H.S. %	Operations done on farm			If not done why not				
			By boy alone	Boy helped	By others	No tools	Lack of skill	Lack of time	No need	Neglect
Adjust carburetor	V.A.	34.1	2.5	.8					3.2	
	N.V.A.				2.5		2.0			
Clean carburetor jets	V.A.	11.4			2.9				15.6	
	N.V.A.		1.8	4.9			9.3			
Replace carburetor float	V.A.	11.4	5.4	.4				2.9		
	N.V.A.				2.0		1.6		2.7	
Clean gas line	V.A.	2.9	7.4							
	N.V.A.			2.0	2.5				.8	
Repair fuel tank	V.A.		22.6	5.7						
	N.V.A.						7.3		18.5	
Replace or repair fuel pump	V.A.								17.7	
	N.V.A.		1.0	4.9	6.9		2.5			
Grind valves	V.A.	31.4	2.2		2.9	5.7			6.5	
	N.V.A.			6.9			8.0			
Replace valve springs	V.A.	17.1	4.2			2.9			23.7	
	N.V.A.			7.3			21.1			
Time valves	V.A.	51.4	11.6	3.2		2.9			5.9	
	N.V.A.				4.9		16.3			

Table 9. (Contd.)

Adjust valve stem clearance	V.A.	14.3	3.1	5.7		5.7			3.4	
	N.V.A.				2.0		13.4			
Replace rings	V.A.	11.4	4.6			5.7			15.1	
	N.V.A.			6.0	2.0		15.0			
Replace sleeves	V.A.	2.9	3.4		.4	5.7			19.7	
	N.V.A.			8.5			18.2			
Take up bearings	V.A.	11.4	17.3			5.7		.4	7.0	
	N.V.A.			15.8	1.6		10.6			
Replace bearing inserts	V.A.		13.6		2.9	2.9			5.4	
	N.V.A.			9.3			13.0			
Clean carbon from cyclinders	V.A.		7.2		.4				6.1	
	N.V.A.			3.6			5.2			2.5
Replace wrist pins and bushings	V.A.		10.3			8.6			11.5	
	N.V.A.			8.5	4.4		10.1	4.9		
Repair oil pump	V.A.		18.0	.8	.4					
	N.V.A.						8.9		8.0	
Replace oil filter	V.A.			3.7			2.9		4.9	
	N.V.A.		4.6		4.4					
Clean oil lines	V.A.		1.0				.4		7.8	
	N.V.A.			2.0	4.9					
Time ignition	V.A.	48.5	14.8		.4					
	N.V.A.			1.2			5.7		6.0	

Table 0. (Concl.)

Replace distributor points	V.A.			9.8			1.6		8.3	
	N.V.A.		10.0		7.3					
Clean and adjust distributor points	V.A.		.3	9.4			3.2		1.6	
	N.V.A.				12.2					
Clean and adjust magneto breaker points	V.A.		3.1	.8	.4		1.3			
	N.V.A.								3.1	
Clean and adjust spark plugs	V.A.	5.7	3.6	.8					2.9	
	N.V.A.				4.9					
Replace spark plugs	V.A.	2.9		.8					11.4	
	N.V.A.		7.3		2.5					
Check and replace wiring	V.A.	2.9	6.0	1.3					7.3	
	N.V.A.				4.9		7.3			
Flush radiator	V.A.					2.9			5.8	5.7
	N.V.A.		7.8	1.6	2.5					
Repair radiator	V.A.		13.6	3.2						
	N.V.A.				2.0		6.5		5.9	
Repair water pump	V.A.					2.9	3.7	2.9	6.7	
	N.V.A.		7.4	1.6	4.9					

running gear. Not all jobs were applicable to each wagon checked, as a few wagons were of the rubber tired, car chassis, trailer type and some had steel wheels which eliminated the need of tightening fellows or wedging tires. All vocational boys reported having a wagon of some type on the farm, while 97.6 per cent of the non-vocational group reported a wagon. Where a wagon was not found on the farm it had been replaced by a truck. Of the 17 repair operations on the wagon 11 were performed by more vocational-agriculture boys and six by more of the non-vocational boys. Those jobs which were performed more commonly by the non-vocational boys were those involving woodwork, such as repairing the wagon box, rebuilding the box, and repairing the standards. This indicates that the boy who had woodworking in manual training has made use of the skills learned in this course by applying them when needed on the farm. In five of the 17 jobs the farm-shop boy helped more frequently than did the manual-training boy, while the manual-training boy helped to a greater extent with 12 of these jobs. The job was done by others more frequently in all 17 repair operations with the non-vocational boy than in the case of the vocational boy. The repair operations on the wagon indicate that the boy is more likely to attempt those jobs in which he had training than those in which he had little or no instruction. The boy who has been trained in the manual-training shop and thus acquired more skill in the use of woodworking tools has more of a tendency to undertake those operations involving work with wood. The boy from the vocational-agriculture shop having had training in more varied

Table 10. Showing the difference in the percentage of vocational-agriculture and non-vocational-agriculture boys who performed the repair operations on the wagon.

Repair operations	Group	taught job in H.S. %	Operations done on farm By boy alone	Boy helped	By others	If not done why not No tools	Lack of skill	Lack of time	No need	Neglect
Repair wagon box	V.A.			5.8					11.1	
	N.V.A.		2.3		7.3			2.5		
Build new box	V.A.	2.9						3.2	20.6	
	N.V.A.		6.5	8.1	4.4					
Renew floor in box	V.A.		3.7					5.7	7.5	
	N.V.A.			9.7	4.9					
Make new irons	V.A.	5.7	18.0					2.9	5.2	
	N.V.A.			4.9	7.3	2.0	9.3			
Replace coupling pole	V.A.		10.4							
	N.V.A.			.3	7.3				.3	
Repair reach	V.A.		18.1						3.4	
	N.V.A.			4.4	14.6					
Repair circle	V.A.		10.7						2.2	
	N.V.A.			.8	9.8					
Tighten standards	V.A.								8.6	5.7
	N.V.A.		1.4	1.2	9.3					
Replace standards	V.A.								14.8	
	N.V.A.		2.7	.3	6.9			2.5		

Table 10. (Contd.)

Replace bolster	V.A.						13.6	
	N.V.A.	.3	1.5	6.9				2.5
Repair hounds	V.A.	5.4	5.4				5.9	
	N.V.A.			9.3	2.5	2.5		
Replace hounds	V.A.		1.6				11.7	
	N.V.A.	3.9		4.4	2.5			
Replace tongue	V.A.	.6	.9				15.6	
	N.V.A.			12.2	2.5			
Tighten fellows	V.A.	4.2			.6		16.1	
	N.V.A.		12.2	6.5				
Wedge on tires	V.A.	5.4	4.9				7.0	5.7
	N.V.A.			4.9	19.0	2.5		
Paint wheels and running gear	V.A.	1.8				.4	9.1	6.6
	N.V.A.		5.4	9.8				
Paint wagon box	V.A.	22.7						2.1
	N.V.A.		3.6	6.9		2.0		

skills will attempt a wider range of repair jobs.

A summary of the repair activities of both groups of boys is given in Table 11. It may be observed that the boys who have taken vocational-agriculture in high school have performed more of the repair operations for every machine used in the study, than did those who have not had this instruction. One hundred fifteen repair operations were checked on the five implements. There were more vocational-agriculture boys who had performed 92 of these operations than there were of the non-vocational boys, and that with a mean difference in percentage of 11.1. Of the 23 operations which were performed by more of the non-vocational boys a mean difference of only 4.9 per cent was found. This indicates that the difference was slight even in those jobs which were done by more of the non-vocational boys.

Table 11. Participation in farm machinery repair work.

Kind of implement	No. jobs	No. jobs participated in by boys from		Mean difference in jobs (percent)	
		V.A.	Non V.A.	V.A.	Non V.A.
Mower	26	25	1	12.9	10.4
Plow	23	17	6	13.2	6.3
Grain drill	20	17	3	11.8	2.6
Gasoline motor	29	22	7	8	5.7
Wagon	17	11	6	9.2	2.9
Total	115	92	23		

Another interesting observation from the former tables is that of the 115 repair operations checked 101 were done more frequently by others on the farms of the non-vocational boys than in the case of the vocational boys, while in only 10 of these did the vocational boy depend more upon others for doing the work. In those cases where the vocational agriculture boy depended more on others the mean difference was 1.2 per cent while the mean difference for the jobs which were done by others more frequently on the farms of non-vocational boys was 6.6 per cent. The non-vocational-agriculture boys depended on others to do more of the repair operations for each machine studied than did the vocational-agriculture group.

Few jobs not done on the farm were reported because of a lack of skill by either group, but in all cases there were more non-vocational boys reporting the jobs left undone because of a lack of skill. The non-vocational boys reported this reason for not doing 34 of the jobs more frequently with a mean difference of 9.9 per cent and 12 vocational boys with a mean difference of 1.8 per cent. These differences indicate that the vocational-agriculture boys at least have more confidence in their ability for performing more of the repair operations than do those without vocational-agriculture-shop training.

While the differences found from the study were not great in most comparisons, they consistently favored the boy with the training from the vocational-agriculture farm shop. Since other factors were controlled as nearly as possible, it would seem logical to assume that the difference as shown in these two groups is due to the nature and length of their training periods.

SUMMARY AND CONCLUSIONS

1. This study was made to determine the effectiveness of the mechanical training for boys who have had instruction in the vocational-agriculture farm shop. The repair of five representative farm implements on each farm visited was checked as a basis for determining the extent of participation. As a means of comparison, farm boys who had completed the vocational-agriculture instruction from the schools offering this training were checked with farm boys who had completed their high school courses from schools not offering vocational agriculture. Thirty-five boys from five vocational agriculture schools and 41 boys from four schools not offering vocational agriculture were visited in securing data for the study.

2. Boys with vocational-agriculture instruction showed more progress towards becoming established in farming than did boys from the communities where vocational agriculture was not offered. This is evidenced by the fact that 88.5 per cent of the former group had some degree of ownership in farming enterprises as shown by Table 1, while only 55.1 per cent of the latter group owned an interest in farming enterprises.

3. While there were more of the non-vocational-agriculture boys in the communities included in the survey who lived on farms owned by their parents or themselves, there is no reason to justify a belief that this would be a normal condition brought about by the difference in the instruction received by the two groups. This and the longer tenure on their present farms, as

indicated by the survey, would tend to give the non-vocational boys a decided advantage in the points covered by the survey over the vocational-agriculture boys.

4. A few of the boys who took the courses offered in vocational-agriculture supplemented the mechanical instruction received therein by one or two units in either manual training or industrial arts. Statements made by the boys, during the interview, however, indicated that no instruction in machinery repair was included in any of the manual training or industrial arts courses. All boys receiving definite machinery-repair instruction in high school reported that this instruction was received in the vocational-agriculture farm shop.

5. Boys who have had instruction in the vocational-agriculture farm shop realized the need of adequate facilities for making farm-machinery repairs. This is evidenced by the fact that more of the vocational-agriculture boys had some centralized place which could be used as a shop and more of them had shops which could be heated or room provided for taking farm machinery inside to be repaired.

6. The instruction and influence from vocational agriculture has been instrumental in influencing more boys with this training to establish organized methods of storing tools than those who did not take vocational agriculture, as shown by the fact that 74.3 per cent of vocational-agriculture boys had either tool cabinets or definite racking systems, while only 53.7 per cent of the non-vocational boys had an organized system of caring for tools.

7. The boys who did not study vocational agriculture had a larger ownership of farm machinery than the vocational-agriculture boys. This probably was due to the fact that the farmers from two of these communities had other sources of income than from the farm.

8. Boys who have had training in the vocational-agriculture shop undertook more machinery repair operations by themselves than those without the vocational training. These boys apparently have gained a confidence in themselves which has encouraged them in undertaking, even those repair operations about which they have had no organized instruction.

9. Boys who had had definite training in a given skill had more of a tendency to participate in that skill on the farm than did those who had not been thus trained. This is evidenced by the fact that more of the non-vocational group undertook those repair operations involving woodwork than those which made use of skills in metal work, while the vocational boys with their more varied skill training had performed more operations involving the use of forging, sheet metal, or mechanical tools. All non-vocational boys had instruction in either manual training or industrial arts.

10. There were more non-vocational boys who depended upon someone else on the farm to do repair work than of the vocational group. This is to be expected since it has been shown that more of the vocational boys did the work by themselves.

11. The vocational-agriculture boy's training in mechanical skills seems to be a factor influencing the repair of

machinery on the farm by either himself or others. This is evidenced by the fact that in 35 cases where the machinery-repair operations were not done on the farm because of a lack of skill, there were more non-vocational boys reporting this to be the case than vocational boys, while in 11 such cases there were more vocational-agriculture boys who reported that the job had not been done because of a lack of skill.

12. There is a need for more instruction in the skills involved in the repair of farm machinery in the vocational agriculture shop than has been given in the past as evidenced by the evidence presented in this study. In a number of cases, however, the interview brought forth the fact that instruction was not given in particular skills when the boy interviewed was in school, but the boys now enrolled were receiving the training. This indicates there has been improvement in the content of the farm shop courses since the boys who were included in the survey were in school.

13. All high schools that enroll a number of farm boys should provide some type of mechanical instruction for these boys that will better fit them to perform those repair operations needed on the farm. This statement is based on the fact that farmers are now living in a machine age in which most farm operations are performed by some type of machinery. The farmer of the future should be prepared to make most of the machinery repairs and adjustments on the farm.

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APPENDIX

Check sheet of farm machinery repair operations
performed by farm boys who have been out of high
school from one to five years.

(to be filled in by interviewer)

Name ______________________ age ___ year of graduation from H.S. ______

1. Status of farming (check one which best represents case)

___ working for father ___ working for others

___ partnership with father ___ farming for self

___ working for father with one or more interprises for self

Is farm owned by operator? ______

II. Training in mechanical skills:

	credit units:
Manual training	________
Industrial art	________
Vocational Agriculture	________
______________	________

III. Farm facilities for machinery repair:

A. Place work is done (check place where work is done most frequently)

___ under a tree ___ regular farm shop

___ beside house or barn ___ implement shed

___ corner of barn ___ granary or driveway

___ in garage ___ ______________________

Is shop provided with heat for cold weather? ______

Is there room to take farm implements inside? ______

B. How long have you lived on this farm? __________

C. Tool storage (check most centrally located place)

___ in organized tool chest or cabinet

___ tool racks above work bench

___ lying on top of work bench

___ in tool boxes on implements

___ no definite place

___ ______________________

IV. Farm machinery repair operations (continued)

Repair operations:	Implement owned by		in what subject was job taught in high school	operations done on farm			if not done why not				
	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
MOWER											
correct lead of cutter bar											
check centering of knife											
adjust for wear of yoke pins											
replace guards											
replace ledger plates											
align guards											
replace wearing plates											
straighten knife clips											
replace knife clips											
replace knife head guides											
adjust inner shoe											
adjust outer shoe											
repair divide board											
replace sections											
sharpen sickle											
replace knife head											
straighten knife back											
replace dogs and springs											
replace bearings											
replace clutch parts											

IV. Farm machinery repair operations (continued)

	Implement owned by		in what subject was job taught in high school	operations done on farm			if not done why not				
Repair Operations	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
replace worn gears											
replace crank pin											
replace pitman shaft bearing											
replace pitman											
replace tongue											
straighten and adjust levers											
SULKY OR GANG PLOW											
sharpen share											
adjust wing bearing											
repoint share											
adjust vertical suction											
adjust land suction											
replace landslide											
tighten moldboard											
polish moldboard											
straighten beam											
tighten beam											
replace broken braces											
tighten braces and bolts											
sharpen rolling coulter											
replace rolling coulterbearing											

IV. Farm machinery repair operations (continued)

	Implement owned by		In what subject was job taught in high school	operations done on farm			if not done why not				
Repair Operations	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
adjust position of coulter											
replace wheel bearings											
clean bearings and oilers											
adjust angle of furrow wheels											
replace worn collars											
straighten frame											
straighten levers											
adjust spring tension											
paint plow											
GRAIN DRILL											
rebuild box											
check planting rate											
replace worn gears											
replace worn bearings											
repair feed cups											
replace broken flutes											
replace broken feed wheels											
replace worn links in chains											
repair grain tubes											
replace or repair discs											

IV. Farm machinery repair operations (continued)

	Implement owned by		in what subject was job taught in high school	operations done on farm			if not done why not				
Repair Operations	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
replace or repair scrapers											
replace wheel bearings											
adjust pressure springs											
replace broken springs											
tighten bolts and braces											
replace broken braces											
replace tongue											
replace dogs and springs											
replace or repair drag chains											
paint box											
GASOLINE MOTOR											
adjust carburetor											
clean carburetor jets											
replace carburetor float											
clean gas line											
repair fuel tank											
replace or repair fuel pump											
grind valves											
replace valve springs											
time valves											
adjust valve stem clearance											

IV. Farm machinery repair operations (continued)

Repair operations:	Implement owned by:		in what subject Was job taught in high school	Operations done on farm			If not done why not.				
	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
replace rings											
replace sleeves											
take up bearings											
replace bearing inserts											
clean carbon from cylinders											
replace wrist pins & bushings											
repair oil pump											
replace oil filter											
clean oil lines											
time ignition											
replace distributor points											
clean & adjust distributor points -											
clean & adjust magneto breaker points -											
clean and adjust spark plugs											
replace spark plugs											
check and replace wiring											
flush radiator											
repair radiator											
repair water pump											
WAGON											
repair wagon box											
build new box											
renew floor in box											

IV. Farm machinery repair operations (concluded)

	Implement owned by		in what subject was job taught in high school	operations done on farm			if not done why not				
Repair Operations	boy	father		by boy alone	boy helped	by others	no tools	lack of skill	lack of time	no need	neglect
make new irons											
replace coupling pole											
repair reach											
repair circle											
tighten standards											
replace standards											
replace bolster											
repair hounds											
replace hounds											
replace tongue											
tighten fellows											
wedge on tires											
paint wheels and running gear											
paint wagon box											